

Amendment

U.S. Patent Application No. 09/931,268

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Currently Amended) A method for determining the concentration of an additive X of an electrochemical bath that includes at least one further component Y, the method comprising:
 - providing a predetermined amount of a starting solution, the starting solution comprising virgin makeup solution that is saturated with the further additive component Y;
 - extracting an amount of the electrochemical bath for measurement;
 - adding a predetermined amount of the extracted electrochemical bath to the predetermined amount of the starting solution to form a mixed solution;
 - executing at least one electroanalytical measurement cycle using the mixed solution; and
 - comparing results of the electroanalytical measurement cycle with a known measurement standard.

2. (Original) The method of claim 1 wherein a plurality of electroanalytical measurement cycles are executed using the mixed solution and wherein the mixed solution used in the electroanalytical measurement cycles comprises mixed solutions having different amounts of the extracted electrochemical bath added thereto.

Amendment

U.S. Patent Application No. 09/931,268

3. (Original) The method of claim 1 wherein the at least one electroanalytical measurement cycle comprises cyclic voltammetric stripping.

4. (Original) The method of claim 1 wherein the at least one electroanalytical measurement cycle comprises cyclic pulse voltammetric stripping.

5. (Currently Amended) The method of claim 1 wherein the known measurement standard is obtained prior to the comparing results of the electroanalytical measurement cycle by executing a plurality of electroanalytical measurement cycles using a standardized solution comprising virgin makeup solution that is saturated with ~~the additive X and~~ the further component Y.

6. (Original) The method of claim 1 wherein the additive X is an electroplating suppressor.

7. (Original) The method of claim 1 wherein the component Y is an electroplating enhancer.

8. (Currently Amended) A method for determining the concentration of suppressor in an electroplating bath that also includes an electroplating enhancer, the method comprising:

Amendment

U.S. Patent Application No. 09/931,268

providing a predetermined amount of a starting solution comprising virgin makeup solution that is saturated with the enhancer;

extracting an amount of the electroplating bath for measurement;

adding a predetermined amount of the extracted electroplating bath to the predetermined amount of the starting solution to form a mixed solution;

executing at least one electroanalytical measurement cycle using the mixed solution; and

comparing results of the at least one electroanalytical measurement cycle with a known measurement curve.

9. (Original) The method of claim 8 wherein a plurality of electroanalytical measurement cycles are executed using the mixed solution and wherein the mixed solution used in the electroanalytical measurement cycles comprises mixed solutions having different amounts of the extracted electroplating bath added thereto.

10. (Original) The method of claim 8 wherein the at least one electroanalytical measurement cycle comprises cyclic voltammetric stripping.

11. (Original) The method of claim 8 wherein the at least one electroanalytical measurement cycle comprises cyclic pulse voltammetric stripping.

Amendment

U.S. Patent Application No. 09/931,268

12. (Currently Amended) The method of claim 8 wherein the known measurement curve is obtained prior to the comparing results of the electroanalytical measurement cycle by executing a plurality of electroanalytical measurement cycles using a standardized solution comprising virgin makeup solution that is saturated with the enhancer ~~and suppressor~~.

13. (Currently Amended) A method for determining the concentration of an additive X of an electrochemical bath that includes at least one further component Y, the method comprising:

providing a predetermined amount of a starting solution, the starting solution comprising virgin makeup solution that includes a predetermined amount of the further component Y;

extracting an amount of the electrochemical bath for measurement;

adding a predetermined amount of the starting solution to form a mixed solution, the mixed solution being saturated with the at least one further component Y;

executing at least one electroanalytical measurement cycle using the mixed solution; and

comparing results of the electroanalytical measurement cycle with a known measurement standard.

14. (Currently Amended) A method for determining the amount of an electrochemical bath additive that is to be automatically added to an electrochemical bath by a dosing system, the amount of the electrochemical bath additive that is to be added being dependent on a measurable

Amendment

U.S. Patent Application No. 09/931,268

value related to an amount of a component X in the electrochemical bath, the electrochemical bath also including at least one further component Y, the method comprising:

providing a predetermined amount of a starting solution, the starting solution comprising virgin makeup solution that is saturated with the further component Y;

automatically extracting an amount of the electrochemical bath for measurement;

automatically adding a predetermined amount of the extracted electrochemical bath to the predetermined amount of the starting solution to form a mixed solution;

automatically executing at least one electroanalytical measurement cycle using the mixed solution; and

automatically using the results of the electroanalytical measurement cycle to determine the amount of additive that is to be dispensed by the dosing system.

15. (Original) The method of claim 14 wherein the electroanalytical measurement cycle comprises cyclic voltammetric stripping.

16. (Original) The method of claim 14 wherein the electroanalytical measurement cycle comprises cyclic pulse voltammetric stripping.

17. (Previously Presented) An automated chemical management system comprising:
a bath extractor connected to extract an amount of an electrochemical bath from an electrochemical processing unit, the bath extractor being adapted to extract an electrochemical

Amendment

U.S. Patent Application No. 09/931,268

bath that is comprised of a first bath additive, the amount of which is to be determined by the automated chemical management system, and a second bath additive,

an electroanalytical measurement system including a container in which electroanalytical measurements are conducted, the container being adapted to hold an amount of virgin makeup solution that is saturated with the second bath additive,

a programmable control system connected to control the bath extractor and the electroanalytical measurement system, the programmable control system being programmed to direct the bath extractor and electroanalytical measurement system for execution of a series of operations to determine the amount of the first bath additive in the electrochemical bath that has been extracted from the electrochemical processing unit, the operations comprising

extracting an amount of the electrochemical bath from the electrochemical processing unit for measurement of the amount of the first bath additive therein,

dispensing an amount of a virgin makeup solution that is saturated with the second bath additive into the container to form a mixed bath,

executing at least one electroanalytical measurement cycle using the mixed bath, determining the amount of the first bath additive in the extracted electroplating bath using one or more measurements obtained in the at least one electroanalytical measurement cycle using the mixed bath.

Amendment

U.S. Patent Application No. 09/931,268

18. (Original) The automated chemical management system of claim 17 wherein the first bath additive is an electroplating suppressor in the second bath additive is an electroplating enhancer.

19. (Original) The automated chemical management system of claim 17 wherein the electroanalytical measurement system executes cyclic voltammetric stripping.

20. (Original) The automated chemical management system of claim 17 wherein the electroanalytical measurement system executes cyclic pulse voltammetric stripping.

21. (Currently Amended) The automated chemical management system of claim 17 wherein the programmable control system determines the amount of the first additive by comparing one or more measurements obtained during the at least one electroanalytical measurement cycle to one or more measurements obtained using a standardized solution, the standardized solution comprising virgin makeup solution that is saturated with ~~both the first and~~ second bath additives additive.

22. (Previously Presented) The automated chemical management system of claim 17 and further comprising a chemical dosing system connected to dispense an amount of the first bath additive based on the amount of the first bath additive in the extracted electroplating bath as determined by the programmable control system.

Amendment

U.S. Patent Application No. 09/931,268

23. (New) An automated chemical management system comprising:

a means for extracting an amount of an electrochemical bath from an electrochemical processing unit, the means for extracting being adapted to extract an electrochemical bath that is comprised of a first bath additive, the amount of which is to be determined by the automated chemical management system, and a second bath additive,

an electroanalytical measurement system comprising a means for conducting electroanalytical measurements and for holding an amount of virgin makeup solution that is saturated with the second bath additive, and

a control system including a means for controlling the means for extracting and the electroanalytical measurement system to facilitate the execution of a series of operations to determine the amount of the first bath additive in the electrochemical bath that has been extracted from the electrochemical processing unit, wherein the operations comprise:

extracting an amount of the electrochemical bath from the electrochemical processing unit for measurement of the amount of the first bath additive therein,

dispensing an amount of a virgin makeup solution that is saturated with the second bath additive into the means for conducting so as to form a mixed bath,

executing at least one electroanalytical measurement cycle using the mixed bath,
and

Amendment

U.S. Patent Application No. 09/931,268

determining the amount of the first bath additive in the extracted electroplating bath using one or more measurements obtained in the at least one electroanalytical measurement cycle using the mixed bath.

24. (New) A chemical management system for measuring a first bath additive in a sample containing at least the first bath additive and a second bath additive, comprising:

an electroanalytical measurement system in which electroanalytical measurements are conducted, the electroanalytical measurement system being adapted to hold the sample and an amount of virgin makeup solution that is saturated with the second bath additive, and

a control system configured to execute a series of operations to determine the amount of the first bath additive in the sample when the sample and the virgin makeup solution are combined within the electroanalytical measurement system to form a mixed bath, the operations comprising

obtaining at least one electroanalytical measurement using the mixed bath, and
determining the amount of the first bath additive in the sample using the at least one electroanalytical measurement obtained using the mixed bath.

25. (New) A method for determining the concentration of an additive X in a sample that includes at least the additive X and a further component Y, the method comprising the steps:

(a) providing a starting solution, the starting solution comprising virgin makeup solution that is saturated with the further component Y;

Amendment

U.S. Patent Application No. 09/931,268

(b) adding the sample to the starting solution to form a mixed solution;

(c) executing at least one electroanalytical measurement using the mixed solution; and

(d) comparing results of the at least one electroanalytical measurement with a known measurement standard.

26. (New) A chemical management system for measuring a first bath additive in a sample containing at least the first bath additive and a second bath additive, comprising:

a measurement system including means for holding the sample and an amount of virgin makeup solution that is saturated with the second bath additive and for conducting electroanalytical measurements, and

a control system including:

means for executing a series of operations to determine the amount of the first bath additive in the sample when the sample and the virgin makeup solution are combined within the means for holding to form a mixed bath; and

means for conducting electroanalytical measurements, wherein the series of operations comprise:

obtaining at least one electroanalytical measurement using the mixed bath;

and

determining the amount of the first bath additive in the sample using the at least one electroanalytical measurement obtained using the mixed bath.